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A new species of seagrass-boring *Limnoria* (Limnoriidae, Isopoda, Crustacea) from Japan

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Abstract

The marine seagrass-boring isopod, *Limnoria rhombipunctata* **sp. nov**. (Limnoriidae) is described from the rhizome of *Phyllospadix iwatensis* seagrass, in shallow coastal waters off Chiba Prefecture, Japan. *L. rhombipunctata* **sp. nov**. is distinguished from other *Limnoria* species by the unique carinae of pleonite 5 and pleotelson, two branched lacinia mobilis of the right mandible, 3 flagellar articles of antenna 1, and triangular epipod of the maxilliped. Specimens of *L. magadanensis*, a species similar to *L. rhombipunctata* **sp. nov**., are re-examined and compared with *L. rhombipunctata* **sp. nov**.

Key words: *Phyllospadix iwatensis*, *Limnoria rhombipunctata* **sp. nov**., *Limnoria magadanensis*, taxonomy

Introduction

The isopod suborder Limnoriidea contains 3 families, 5 genera, and 65 species, including wood, algae, and seagrass borers. The 5 genera include: *Hadromastax* Bruce, 1988 (Family: Hadromastacidae, 3 species), *Keuphylia* Bruce, 1980 (Family: Keuphyliidae, 1 species), *Paralimnoria* Menzies, 1957 (Family: Limnoriidae, 2 species), *Lynseia* Poore, 1987 (Family: Limnoriidae, 3 species), and *Limnoria* Leach, 1814 (Family: Limnoriidae, 56 species) (Cookson 1991, Cookson & Poore 1994, Nunomura 2008, Castelló 2011, Nunomura 2012). Seagrass borers usually dwell in the rhizomes or sheaths of plants. Brearley *et al.* (2008) reported that *Limnoria agrostisa* caused damage to host plants.

In Japan, 10 species from 2 genera of Limnoriidea are found; namely, *Paralimnoria* and *Limnoria*. Eight species are wood-borers (*P. andrewsi* Calman, 1910; *L. borealis* Kussakin, 1963; *L. hiradoensis* Nunomura 2008; *L. japonica* Richardson 1909; *L. lignorum* Rathke, 1799; *L. nagatai* Nunomura 2012; *L. saseboensis* Menzies, 1957; *L. tuberculata* Sowinsky, 1884) (Richardson 1909, Shiino 1950, Menzies 1957, Kussakin, 1963, Nunomura 2008, Nunomura 2012) and 2 species are algae or seagrass borers (*L. segnoides* Menzies, 1957; *L. zinovae* Kussakin, 1963). *L. segnoides* was reported to have been washed from *Corallina* alga that had been collected at low tide in Misaki, Kanagawa Prefecture, Japan (Menzies 1957). *L. zinovae* was recorded from the rhizomes of *Phyllospadix iwatensis* on Kunashiri Island, Japan (Kussakin 1979).

Phyllospadix iwatensis were collected from shallow waters along the Pacific coast at Choshi-shi, Chiba Prefecture, Honshu Island, Japan. Some *P. iwatensis* specimens had hollow rhizomes that occurred by the foraging activity of *Limnoria rhombipunctata* **sp. nov**., which only feed on the pith of the rhizomes and live in the created tunnels. *L. zinovae* was collected from Kunashiri Island in Japan and Askold Island in Russia, which are located in the Sea of Okhotsk and Sea of Japan, respectively. This species feeds on the same substrate as *L. rhombipunctata* **sp. nov**., however, we were not able to find *L. zinovae* around Choshi-shi.

We re-examined the specimens of *L. magadanensis* Jesakova, 1961 deposited at the Toyama Science Museum (TOYA), which was erroneously identified as *L. japonica* (Nunomura 2011). *L. magadanensis* is similar to the new species. Here, we examine the features of *L. magadanensis* in detail to clarify diagnostic characters. *L. magadanensis* has been previously collected off Antonovo (formerly Randomari Village) on Karafuto Island and Cape Egorov on mainland Russia situated in the Sea of Japan (Kussakin 1963), as well as from Magadan port in

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mainland Russia and the Gulf of Patience (formerly Gulf of Taraika) on Karafuto Island situated in the Sea of Okhotsk (Jesakova 1961). This study is the first report of this species on Honshu Island, Japan.

Materials and methods

The seagrass *Phyllospadix iwatensis* was collected from the subtidal zone off Choshi-shi. Rhizomes of *P. iwatensis* were attached to rocks, just above sea level at the lowest tide. The rhizomes were detached from the substrate using knives and scissors. *Limnoria* individuals were picked out from the rhizomes with tweezers in the laboratory. Morphological observations were conducted under a light microscope and a SEM. Specimens of the new species were deposited in the Kitakyushu Museum of Natural History and Human History (KMNH), Fukuoka Prefecture, Japan.

Taxonomy

Limnoriidea Poore, 2002

Limnoriidae White, 1850

Genus *Limnoria* Leach, 1814

***Limnoria rhombipunctata*, sp. nov.**
Figs. 1–3

Material examined. *Holotype*: male, 4.0 mm (1.0 mm wide pleotelson, with 21 slides), Choshi-shi, Chiba Prefecture, Japan, 35°41' N 140°51' E, subtidal zone, *Phyllospadix iwatensis* rhizomes, Ohsawa A. Takeshi, Yoshino Hiroki, and Watabe Hikari, 20 April 2015 (KMNH IvR 500862).

***Paratypes*:** male, 4.0 mm (KMNH IvR 500867); male, 4.4 mm (KMNH IvR 500868); non-ovig. female, 3.9 mm (KMNH IvR 500863); non-ovig. female, 5.1 mm (KMNH IvR 500864); ovig. female, 4.5 mm (KMNH IvR 500865), same data as holotype.

Type locality. Choshi-shi, Chiba Prefecture, Japan

Description. *Body* oblong and dark yellow in 70% ethanol. Head almost globular. Eyes black in color, each with 8 ocelli. Most of dorsal surface of pereonite, pleonite and pleotelson covered with many small setae. *Pleonite* composed of 5 distinct segments. Pereonal segment 1 longest, approximately 2.2 times longer than segment 2 with 2 obvious lateral grooves. Segments 2–4 nearly equal. Posterior pereonal segments become shorter than anterior ones between segments 4–7.

Pleonite 5 0.6 times as long as pleotelson. Dorsomedial region of pleonite 5 with single elevated tubercle, expanding anteriorly towards border of pleonite; with posterior pair of tubercles. Lateral crests well raised. Tubercles and lateral crests of pleonite 5 covered with small spikes.

Pleotelson with 1 strong median tubercle anteriorly, followed posteriorly by 2 pairs of carinae, and laterally with 1 more pair of short carinae not connected to tubercle. Opposing central carina pair longest and sub-parallel; joined anteriorly to more lateral parts of central carinae that widen posteriorly towards lateral sides. Lateral crests emerge anteriorly, not connected to tubercle. Many solitary scale spikes on tubercles, carinae, and lateral crests. Pleotelson margin with irregular row of dorsally directed spike-like setae from lateral crests to posterior margin of pleotelson, and with fringe of long stout setae, short unsheathed setae and spike-like setae.

Antennae similar in length. Antenna 1 with 3 flagellar articles; second article with 4 aesthetascs. Flagellum of antenna 2 with 4 articles.

Mandibular palp with 3 articles; second article longest, with 1 apical seta and 2 plumose setae; distal article shortest with 4 plumose setae. Mandibular incisors lack rasp and file. Lacinia mobilis of right mandible long and apically bifurcate. Spine row of right mandible composed of 9 stout and serrated setae, progressively increasing in length from first to last. Inner seta on inner lobe of maxilla 2 almost straight.

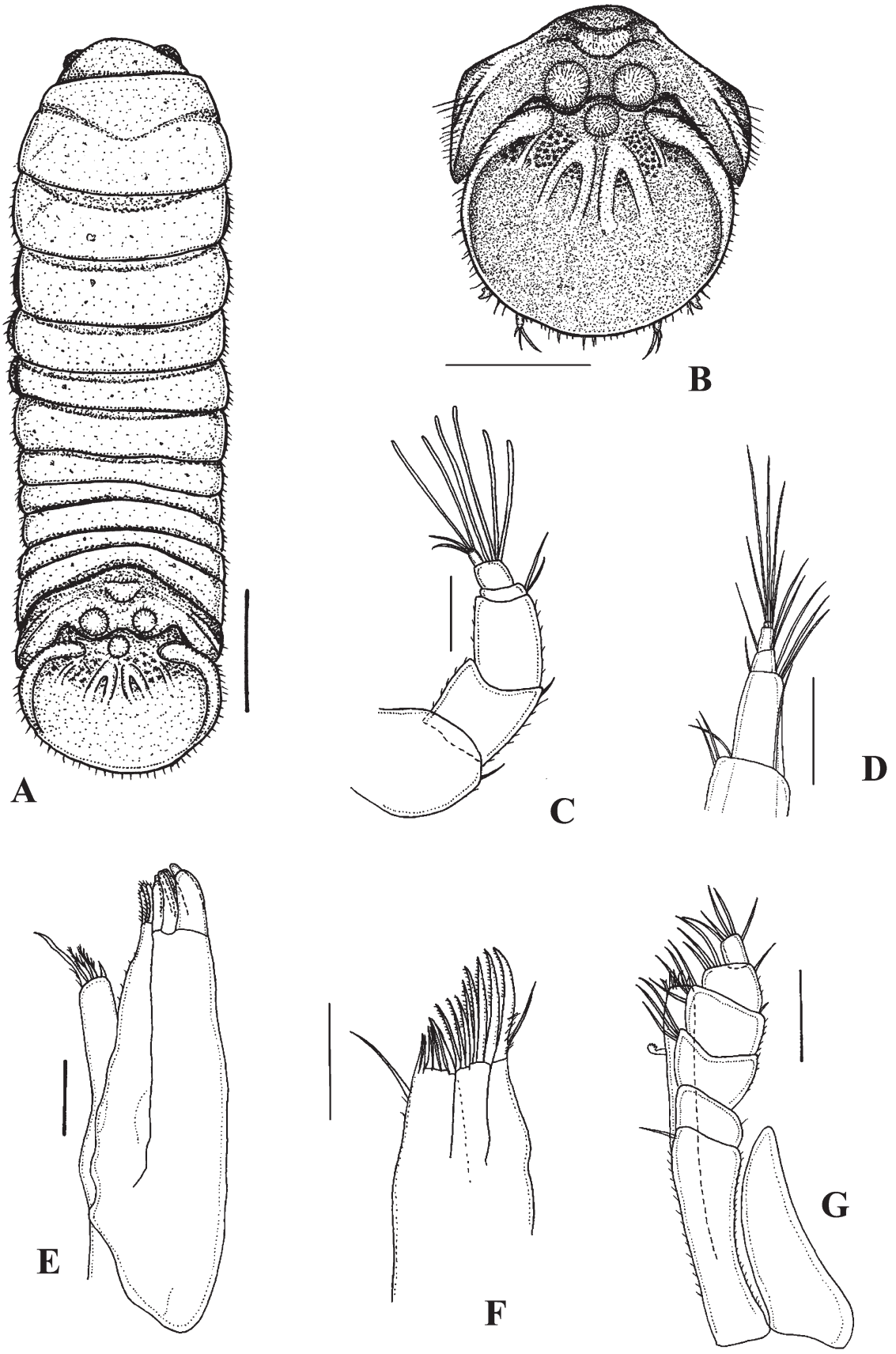

FIGURE 1. *Limnoria rhombipunctata* **sp. nov**. Holotype, male, KMNH IvR 500862: A, dorsal view; B, pleotelson; C, antenna 1; D, antenna 2; E, maxilla 1; F, maxilla 2; G, maxilliped; Scale bars: A = 0.5 mm, B = 0.2 mm, C–D, G = 0.1 mm, E–F = 0.05 mm.

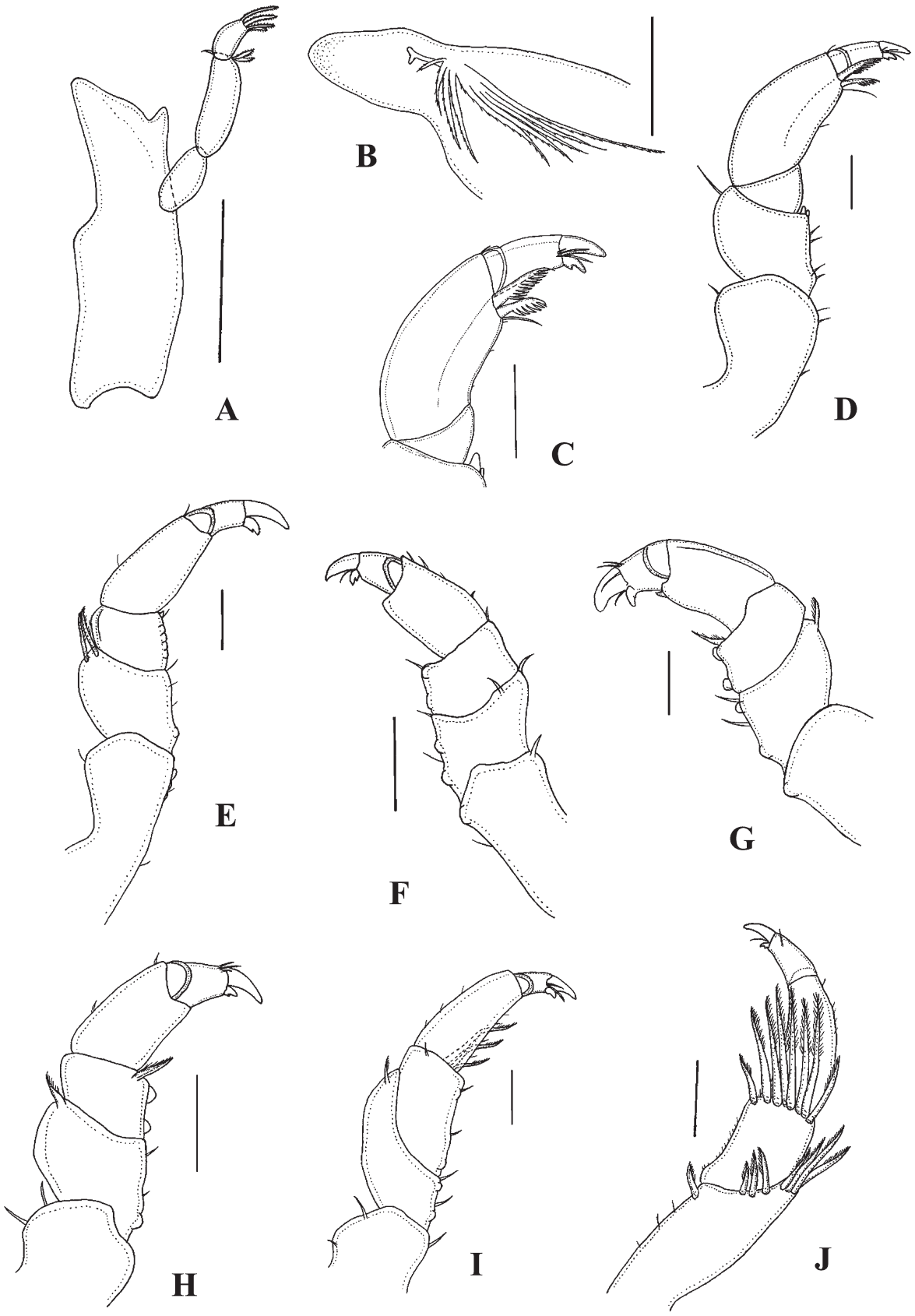

FIGURE 2. *Limnoria rhombipunctata* **sp. nov**. Holotype, male, KMNH IvR 500862: A, left mandible; B, lacinia mobilis of right mandible; C, apical region of pereopod 1; D, pereopod 1; E, pereopod 2; F, pereopod 3; G, pereopod 4; H, pereopod 5; I, pereopod 6; J, pereopod 7. Scale bars: A, C–J = 0.1 mm, B = 0.05 mm.

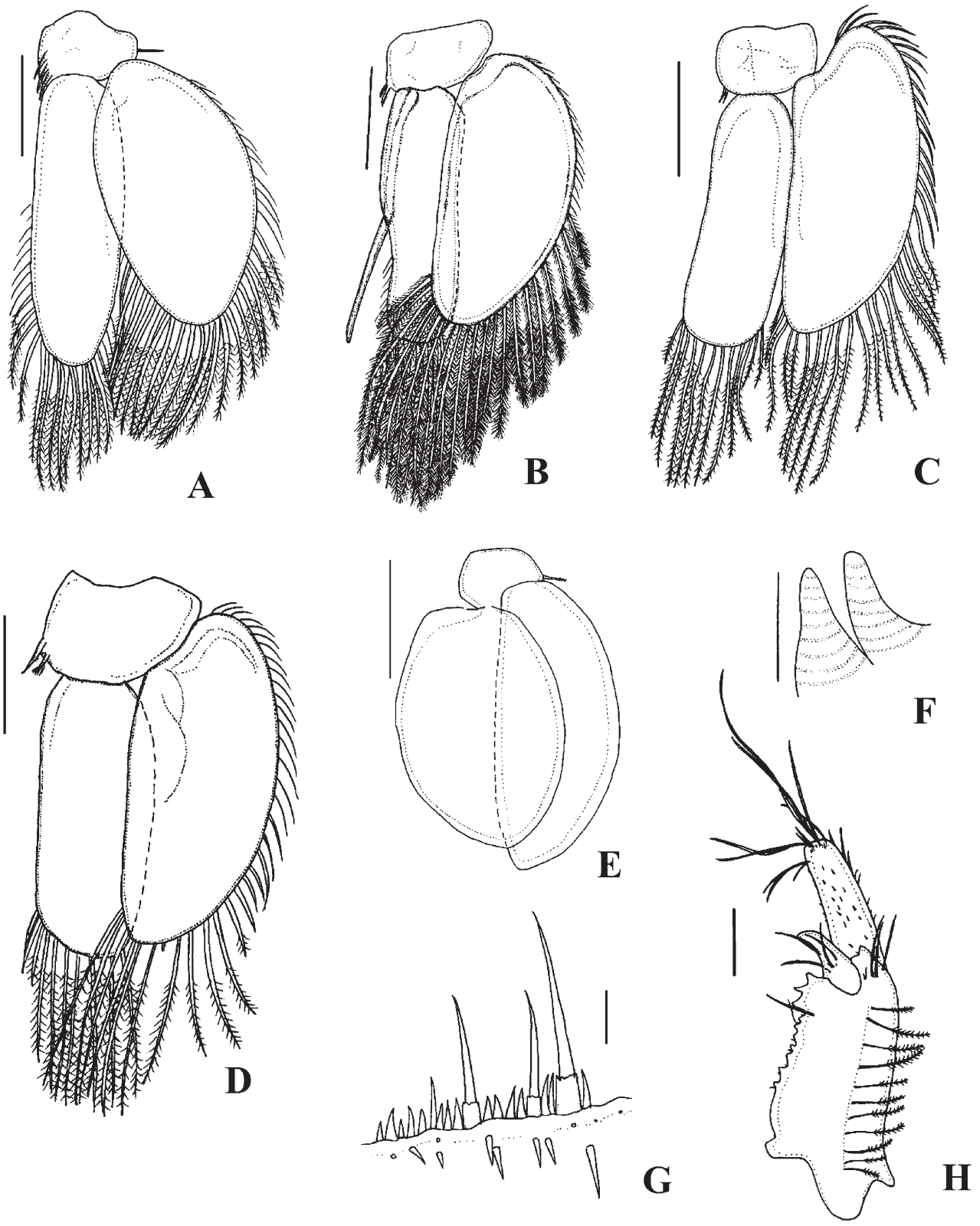

FIGURE 3. *Limnoria rhombipunctata* **sp. nov**. Holotype, male, KMNH IvR 500862: A, pleopod 1; B, pleopod 2; C, pleopod 3; D, pleopod 4; E, pleopod 5; G, posterior margin of pleotelson. Paratype, male, KMNH IvR 500867: F, penes; H, left uropod. Scale bars: A–E = 0.25 mm, F, H = 0.1 mm. G = 0.02 mm.

Epipod of *maxilliped* laterally-concaved triangular, approximately 4 times as long as wide, reaching past palp articulation; epipod lacking simple setae.

Secondary unguis of *pereopods* 1, 2, 3, 6, and 7 bifid, slightly bifid on pereopods 4 and 5. Ventral comb seta on merus of pereopod 7 and carpus of pereopods 5–7.

Pleopod 2 with plumose setae up to 0.5 times length of exopod. Appendix masculina long, reaching beyond endopod tip, articulating near midlength of endopod. Endopod of pleopod 5 shorter than exopod, oval, and 0.6 times as long as endopod of pleopod 2. Peduncles with coupling hook sequence 32220. Peduncle of pleopod 5 with simple seta laterally.

Uropod exopod with 4 simple setae and laterally recurved apical claw. Row of simple setae on endopod only placed apically. Few lateral small tubercles present on uropod peduncle. Uropod endopod 0.7 times as long as peduncle and exopod 0.3 times as long as peduncle.

Substrate. *Phyllospadix iwatensis* rhizome.

Distribution. Known only from the type locality.

Etymology. From the Latin *rhombus*, and the Latin *puncta*, referring to the rhombus shape constituted of 4 tubercles (*puncta*), 3 on pleonite 5 and 1 on the pleotelson.

Remarks. Few records exist of algal-borer limnoriids in Japan, including *L. segnoides* and *L. zinovae*. *L. segnoides* was recorded from Honshu Island, Japan, while *L. zinovae* feeds on the rhizomes of *P. iwatensis* around the Sea of Okhotsk and the Sea of Japan. Both species share the mandibular palp being reduced to a seta, which was also found on the algal-borers *L. bacescui*, *L. bituberculata*, *L. nagatai*, and *L. uncapedis* (Cookson 1991, Pillai 1957, Nunomura 2012, Ortiz & Lalana 1988). The mandibular palp of *L. rhombipunctata* **sp. nov**. has 3 articles, which is a common trait among the *Limnoria*. *L. zinovae* has a Y-shaped carinae on pleonite 5 and no branched lacinia mobilis of right mandible, while *L. rhombipunctata* **sp. nov**. has 3 tubercles and no carina on pleonite 5, and a branched lacinia mobilis of right mandible.

L. magadanensis is distributed in the Sea of Okhotsk and the Sea of Japan (Jesakova 1961, Kussakin 1979). Similarly to *L. rhombipunctata* **sp. nov**. the epipod of maxilliped reaches the palp articulation, there are 3 articles on the mandibular palp, body is covered in small setae, lateral small tubercles on the uropod peduncle, and 4 flagellar articles of antenna 2. However, *L. magadanensis* has semi-triangular epipod of maxilliped, 2 low transverse ridges on pleonite 5, pleotelson with 3 tubercles, and lacinia mobilis with two or three branched spinulate projections at the apex of the right mandible, while *L. rhombipunctata* **sp. nov**. has laterally-concaved triangular epipod of maxilliped, pleonite 5 with 3 tubercles, pleotelson with 1 tubercle, and 2 branches on the lacinia mobilis of right mandible. *L. rhombipunctata* **sp. nov**. is distinguished from *L. borealis*, *L. japonica,* and *L. tripunctata* by the sculpture of pleonite 5 and pleotelson, lacinia mobilis of right mandible, second antenna with 4 flagellum articles, posterior margin of pleotelson, and laterally-concaved triangular epipod of maxilliped.

Limnoria magadanensis Jesakova, 1961

Limnoria magadanensis Jesakova, 1961: 180–186, fig. 1, 2, 5.—Kussakin, 1963: 287, fig. 1c, 4.—Kuhne, 1976: 548–549, fig. 10.—Kussakin, 1979: 329–333, fig. 196–198.
Limnoria japonica Richardson.—Nunomura, 2011: 51-56, fig. 2.

Material examined. male, 7.0 mm (2.3 mm wide pleotelson, with 1 slide, TOYA Cr-22281); male, 8.1 mm (2.5 mm wide pleotelson, with 1 slide, TOYA Cr–22282); male, 6.4 mm (2.0 mm wide pleotelson, with 1 slide, TOYA Cr–22283); male, 6.7 mm (2.0 mm wide pleotelson, with 1 slide, TOYA Cr–22284); male, 7.4 mm (2.5 mm wide pleotelson, with 25 slides, TOYA Cr–22285); male, 6.4 mm (2.2 mm wide pleotelson, with 1 slide, TOYA Cr-22286); non-ovig. female, 6.5 mm (2.0 mm wide pleotelson, with 1 slide, TOYA Cr–22287); non-ovig. female, 7.3 mm (2.2 mm wide pleotelson, with 1 slide, TOYA Cr–22288); non-ovig. female, 7.4 mm (2.1 mm wide pleotelson, with 1 slide, TOYA Cr–22289); non-ovig. female, 8.1 mm (2.3 mm wide pleotelson, with 1 slide, TOYA Cr–22290); ovig. female, 8.4 mm (2.2 mm wide pleotelson, with 1 slide, TOYA Cr–22291), Uozu City, Toyama Prefecture, Japan, submerged pinewood, Kano Yasuo, 21 January 1987.

Type locality. Magadan port on the Sea of Okhotsk, Russia, collected by O. B. Mokievsky.

Note. *Body* oblong and pale yellow in 70% ethanol. Head globular. Eyes black in color, each with 8 ocelli. Maximum length is 8.5 mm (Jesakova 1961). Most of dorsal surface of pereonite, pleonite, and pleotelson covered with many small hairs. Pereonal segment 1 longest, approximately 1.9 times longer than segment 2 with 2 obvious lateral grooves. Segments 2–4 nearly equal. Posterior pereonal segments become shorter than anterior ones among segments 4–7.

Pleonite 5 0.43 times as long as pleotelson. Pleonite 5 with 2 medially located tubercles, anterior tubercle separated from posterior by prominent sulcus. Two tubercles followed by crests laterally.

Pleotelson dorsomedially with single prominent anterior medially located tubercle, followed by pair of large tubercles with no accompanying carinae. Lateral crests emerge anteriorly and their accompanying weak crests connect with anterior tubercle. Posterior margin of pleotelson with dorsally directed row of spike-like setae, and fringe of stout sheathed setae. Lateral crests lack tubercles, but have numerous dorsally directed spike-like setae.

Antenna 1 with 4 flagellar articles; second article with more than 20 aesthetascs. Flagellum of antenna 2 with 4 articles.

Mandibular palp with 3 articles; second article longest with 2 apical setae and distal article shortest with 8 plumose setae. Mandibular incisors with rasp and file. Lacinia mobilis of right mandible broad apically and curved distally, with 2 or 3 branched and spinulate projections at apex. Spine row of right mandible composed of 11 stout and serrated setae progressively increasing in length from first to last. Inner seta on inner lobe of maxilla 2 slightly S-shaped.

Epipod of *maxilliped* semi-triangular, apically rounded, approximately 2.7 times as long as wide, reaching past palp articulation; epipod lacking simple setae.

Secondary unguis of all pereopods clearly bifid. Ventral comb seta on merus of pereopods 6 and 7 and carpus of pereopods 5–7.

Pleopod 2 with plumose setae, up to 0.4 times as long as exopod. Appendix masculina long, reaching beyond endopod tip, articulation near midlength of endopod. Endopod of pleopod 5 anterior to exopod, oval, 1.3 times as long as endopod of pleopod 2. Peduncles of pleopods with coupling hook sequence 32220. Simple seta located on lateral peduncle of pleopod 5.

Uropod exopod with laterally recurved apical blunt claw. Row of simple setae on endopod only placed apically. Many lateral tubercles present on uropod peduncle and exopod. Uropod endopod 0.5 times as long as peduncle and exopod 0.25 times as long as peduncle.

Substrate. Wood.

Distribution. Toyama Bay, Honshu Island, Japan. Previously detected at a depth of 4 to 145 m in the Sea of Okhotsk and the north part of the Sea of Japan.

Remarks. Jeskova (1961) described *L. magadanensis*, and Kussakin (1979) provided additional description. This species was recorded from the Sea of Okhotsk and the north part of the Sea of Japan off mainland Russia and Karafuto Island. The specimens examined here were collected from Toyama Bay off Honshu Island, Japan and incorrectly identified as *L. japonica*. *L. magadanensis* might be distributed throughout the Sea of Japan.

The three tubercles on the pleotelson of *L. magadanensis* are similar to those of *L. borealis, L. japonica, L. orbellum, L. tripunctata,* and *L. tuberculata*. *L. orbellum*, *L. tripunctata,* and *L. tuberculata* are very similar, with 5 flagellar articles on antenna 2, and a triangular epipod of maxilliped with simple setae, but *L. magadanensis* has 4 flagellar articles on antenna 2, and a semi-triangular epipod of maxilliped lacking simple seta. *L. magadanensis* is also distinguished from these 3 species by the sculpturing of pleonite 5, the bifid secondary unguis of all pereopods, the presence of ventral comb seta on merus of pereopods 6 and 7 and carpus of pereopods 5–7, and the small length ratio of endopod/peduncle.

L. magadanensis seems more similar to *L. borealis* and *L. japonica* for antenna 2 with 4 flagellar articles, 2 distinct transverse parallel carinae on pleonite 5, and margin of pleotelson with sheathed setae and dorsally directed numerous spike-like setae. However, *L. magadanensis* differs from *L. borealis* in the semi-triangular epipod of maxilliped, the absence of accompanying carinae behind the pair of tubercles on pleotelson and the absence of an anterior median projection on the posterior carina of the fifth pleonite. Also, *L. magadanensis* has an apically rounded semi-triangular epipod of maxilliped reaching palp articulation, absence of accompanying carinae behind the pair of tubercles on pleotelson, and 2 or 3 branched lacinia mobilis of right mandible. *L. japonica* has a triangular epipod maxilliped not reaching palp articulation, presence of accompanying carinae behind the pair of tubercles on pleotelson, and 4 branched apexes on lacinia mobilis of right mandible.

Discussion

The 65 species in Limnoriidea include at least 23 algae feeders and 7 seagrass feeders (Castelló 2011, Cookson 1991, Cookson & Poore 1994, Cookson 1997, Cookson & Lorenti 2001, Cookson & Poore 1994, Menzies 1957,

Nunomura 2008, Nunomura 2012, Ortiz & Lalana 1962, Haye *et al.* 2012, Kussakin 1963). *Limnoria rhombipunctata* **sp. nov.** is the second species recorded that feeds on the rhizome of *Phyllospadix iwatensis*, following *L. zinovae*. *L. rhombipunctata* **sp. nov**. is recognized by pleonite 5 with 3 tubercles, pleotelson with 3 pairs of carinae, long lacinia mobilis of right mandible with 2 branched apexes, triangular epipod of maxilliped, antenna 1 with 3 flagellar articles, and uropod endopod 0.7 times as long as peduncle.

Nikula *et al.* (2010) and Haye *et al.* (2012) reported that the habitats of *L. stephenseni*, *L. quadripunctata*, and *L. chilensis* extend for several thousand kilometers alongshore. *L. rhombipunctata* **sp. nov.** was recorded off Choshi, approximately 1000 km away from the nearest habitat of *L. zinovae* on Kunashiri Island. The distribution of these 2 species might be limited by temperature tolerance. The results of the morphological analyses indicate that *L. rhombipunctata* **sp. nov**. is similar to wood-boring species (e.g., *L. magadanensis*, and *L. japonica*), whereas *L. zinovae* is similar to algal-boring species (e.g., *L. segnoides*, *L. nagatai*, and *L. bituberculata*) Thus, the adaptation of *Limnoria* to *Phyllospadix iwatensis* occurred independently as parallel evolution.

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References

Brearley, A., Kendrick, G.A. & Walker, D.I. (2008) How does burrowing by the isopod *Limnoria agrostisa* (Crustacea: Limnoriidae) affect the leaf canopy of the southern Australian seagrass *Amphibolis griffithii*? *Marine Biology*, 156 (1), 65–77.
https://doi.org/10.1007/s00227-008-1065-1

Calman, W.T. (1910) XXVI.—On two new species of wood-boring Crustacea from Christmas Island. *Journal of Natural History*, 5 (26), 181–186.
https://doi.org/10.1080/00222931008692749

Castelló, J. (2011) The genus *Limnoria* (Limnoriidae, Isopoda, Crustacea) in Europe, including a key to species. *Zootaxa*, 2968, 1–25.

Cookson, L.J. (1991) Australasian species of Limnoriidae (Crustacea: Isopoda.). *Memoirs of Museum Victoria*, 52, 137–262.

Cookson, L.J. (1997) Additions to the taxonomy of the Limnoriidae (Crustacea: Isopoda). *Memoirs of the Museum of Victoria*, 56, 129–143.

Cookson, L.J. & Lorenti, M. (2001) A new species of Limnoriid seagrass borer (Isopoda) from the Mediterranean. *Crustaceana*, 74 (4), 339–346.
https://doi.org/10.1163/156854001300104426

Cookson, L.J. & Poore, G.C.B. (1994) New species of *Lynseia* and transfer of the genus to Limnoriidae (Crustacea: Isopoda). *Memoirs of the Museum of Victoria*, 54, 179–189.

Haye, P.A., Varela, A.I. & Thiel, M. (2012) Genetic signatures of rafting dispersal in algal-dwelling brooders *Limnoria* spp. (Isopoda) along the SE Pacific (Chile). *Marine Ecology Progress Series*, 455, 111–122.
https://doi.org/10.3354/meps09673

Jesakova, S.E. (1961) A new species of wood boring *Limnoria* - *Limnoria* (*Limnoria*) *magadanensis* sp. nov. (Crustacea Isopoda). *Trudy Instituta Okeanologiya. Akademiya Nauk SSSR*, 49, 180–186. [in Russian]

Pillai, N.K. (1957) A new species of Limnoria from Kerala. *Bulletin of the Central Research Institute, University of Kerala*, 5 (2), 149–157.

Kuhne, H.V. (1976) Zur geographischen Verbreitung holzzerstorender Crustaceen und Systematik der Untergattung *Limnoria* s. str. menzies. *Material und Organismen*, 3, 543–553. [in German]

Kussakin, O.G. (1963) Some data on the systematics of the family Limnoriidae (Isopoda) from northern and far-eastern seas of the USSR. *Crustaceana*, 5 (4), 281–292.
https://doi.org/10.1163/156854063x00237

Kussakin, O.G. (1979) *Morskie i solonovatovodnye ravnonogie rakoobraznye (Isopoda) kholodnykh i umerennykh vod severnogo polushariya. 1. Podotryad Flabellifera* (Marine and Brackish-Water Isopod Crustaceans (Isopoda) of Cold and Temperate Waters of the Northern Hemisphere. Suborder Flabellifera). *Nauka, Leningrad*. [in Russian]

Menzies, R.J. (1957) The marine borer family Limnoriidae (Crustacea, Isopoda). Part I: Northern and Central America:

Systematics, distribution, and ecology. *Bulletin of Marine Science*, 7 (2), 101–200.
Nikula, R., Fraser, C.I., Spencer, H.G. & Waters, J.M. (2010) Circumpolar dispersal by rafting in two subantarctic kelp-dwelling crustaceans. *Marine Ecology Progress Series*, 405, 221–230. https://doi.org/10.3354/meps08523
Nunomura, N. (2008) Marine Isopod crustaceans collected from Shijiki Bay, western Japan (1). Valvifera, Cymothoida, Sphaeromatidea, Limnoriidea and Oniscidea. *Bulletin of the Toyama Science Museum*, 31, 13–43.
Nunomura, N. (2011) Free-living Marine Isopod Crustaceans collected by Dr. Kano from Toyama Bay, the Sea of Japan. *Bulletin of the Toyama Science Museum*, 34, 51–56. [Japanese]
Nunomura, N. (2012) Marine isopod crustaceans of Seto Inland Sea deposited at Toyama Science Museum, 3. Suborder Cymothoida, Limnoriidea and Sphaeromatidea. *Contributions from the Toyama Science Museum*, 35, 77–85.
Ortiz, M. & Lalana, R. (1988) Una nueva especie del genero *Phycolimnoria* (Isopoda, Limnoriidae) de aguas cubanas. *Revista de Investigaciones Marinas*, 9 (2), 37–42. [in Spanish]
Rathke, J. (1799) Jagttagelser henhörende til Indvoldeormenes og Blöddyrenes Naturhistorie. *Skrifter af Naturhistorie-Selskabet København*, 5, 61–148. [in Danish]
Richardson, H. (1909) Isopods collected in the northwest Pacific by the US Bureau of Fisheries Steamer" Albatross" in 1906. *Proceedings of the United States National Museum*, 37, 75–129. https://doi.org/10.5479/si.00963801.37-1701.75
Shiino, S.M. (1951) The marine wood-boring crustaceans of Japan. I. Limnoriidae. *The Wasmann Journal of Biology*, 8, 333–358.
Sowinsky, V.K. (1884) On the crustacean fauna of the Black Sea. *Zapiski Kievskago Obshchestva Estestvoispytatelei*, 7, 225–288.